

THE GENUS TRIGONOSPORA (THELYPTERIDACEAE) IN  
MALESIA

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## SUMMARY

The distribution of the genus is discussed, and the Malesian species distinguished and described. Two new combinations are effected, *Trigonospora calcarata* (Bl.) Holtt. and *T. koordersii* (Chr.) Holtt.; the latter is here recognized for the first time as closely related to *T. calcarata*.

This genus was established by me (*in Blumea* 19:29, 1971). Its essential characters are: caudex short, erect; fronds lacking reduced basal pinnae; pinnae usually deeply lobed with free unbranched veins, basal acroscopic vein passing to the sinus between two lobes, basal basisopic vein to edge above base of sinus; sori indusiate; spores trilete, minutely papillose. All species appear to be adapted to grow on rocks beside streams in shady humid situations.

The main distribution of the genus is throughout India (where suitable habitats occur), eastwards to southern China, southwards to Ceylon, Burma, Thailand and Vietnam; this distribution extends southwards in the Malay Peninsula to about 4° S. latitude; species also occur in Sumatra, Java and N. Celebes (Fig. 1).

In India, especially southern India and in Ceylon, plants belonging to *Trigonospora* are very diversified, and it is difficult to recognize distinct species. The result was that Hooker and Beddome included all Indian plants in one species, in which they included also the Java plants named *Aspidium calcaratum* by Blume; they therefore adopted Blume's specific epithet, transferring it to *Nephrodium* or *Lastrea*. I believe that a thorough comparative study of plants of this genus in India will result in the recognition of several distinct species. Cytological evidence may help the investigation. Manton and Sledge (*in Phil. Trans. R. Soc., B*, 238:137. 1954) reported that a plant named *Thelypteris ciliata* in Ceylon was diploid, with  $n = 36$ ; Abraham (*in Journ Ind. Bot. Soc.* 41:371. 1962) reported both diploid and tetraploid plants under the name *T. pseudo-calcarata*, but did not note any distinguishing features. In view of the

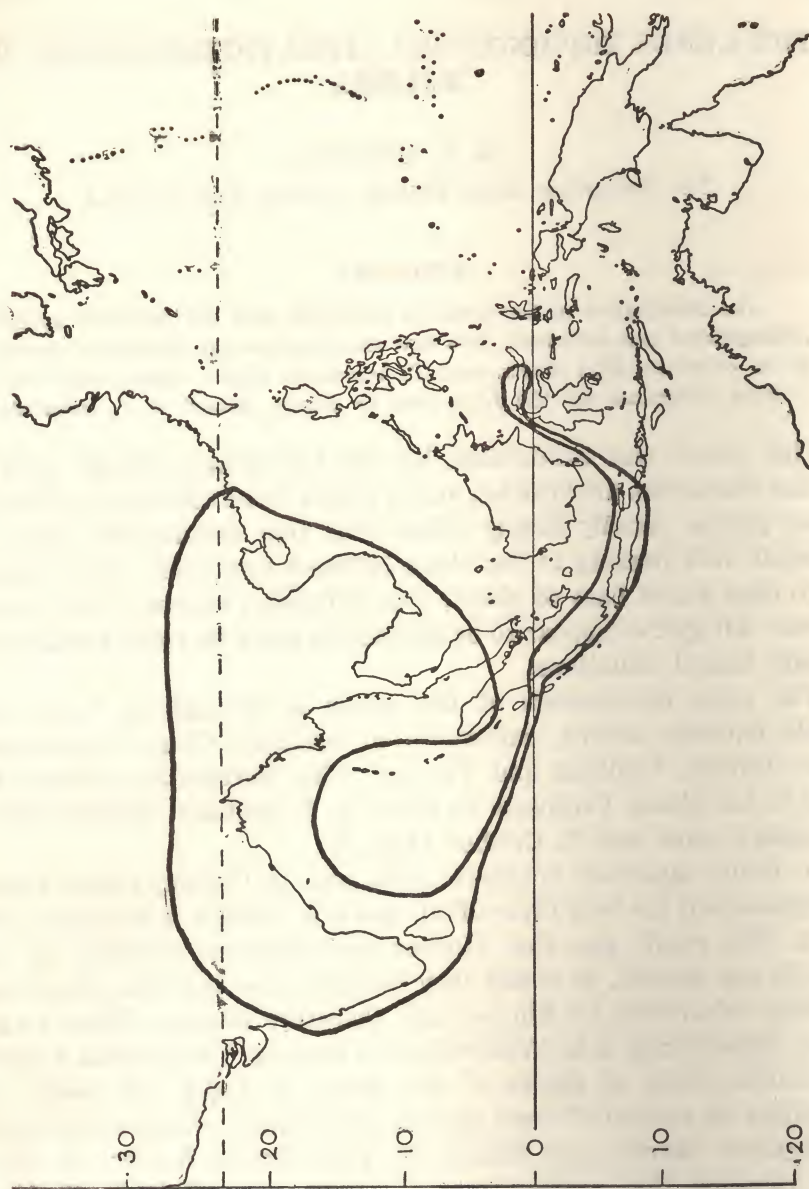


Fig. 1. The distribution of *Trigonospora*.



uncertain position of the Indian and Ceylon plants as regards specific identity, and also as regards confusions of nomenclature, I do not here transfer to *Trigonospora* all the specific epithets already applied to them. But some explanation is needed to show the origin of the names adopted for the species occurring in Malaya and northern Sumatra.

The first name given to Indian plants was *Aspidium ciliatum*, in Wallich's list of the herbarium specimens which he distributed. This name was not accompanied by a description and so has no priority. The name was however used for a fern from Hong Kong by Hooker and by Bentham (see synonymy of *T. ciliata*) and thus should be typified by a Hong Kong specimen. Hooker subsequently placed the name *ciliatum* (which he credited to Wallich) as a synonym of the earlier *calcaratum*. Here, however, the two have to be distinguished. Fortunately the plants in Malaya agree well with the Hong Kong ferns (though not with some from India) and so can be named with confidence.

Among the diversity of specimens of *Trigonospora* from Ceylon is one which is very similar to *Aspidium calcaratum* Bl. of Java, but larger than any Java specimen seen by me. Other Ceylon specimens are somewhat intermediate between this and a form very like the Hong Kong and Malayan *ciliatum* but much larger and with glabrous or nearly glabrous indusia; others are rather intermediate between *calcaratum* and *Thelypteris zeylanica* Ching. I suggest the possibility that Ceylon and southern India was the centre of origin of the genus, and that the plants of Sumatra and Java (where they are very uniform) migrated from Ceylon, thus having a different origin from the plants of *ciliatum* in Malaya which were certainly distributed from the north. There are other examples of closely related species in Ceylon and Java, e.g. *Cyathea crinita* (Hook.) Copel. in Ceylon and *C. tomentosa* (Bl.) Zoll. & Mor. in Java.

An interesting new discovery is that a fern found by Koorders in northern Celebes and named *Aspidium koordersii* by Christ has trilete spores. I had previously been uncertain of the alliance of this species. The spores led me to a comparison between Koorders's specimen and *Aspidium calcaratum* of Java and I found that they agreed well in other characters, so that I am sure of this new extension of distribution of the genus. Surely the Celebes species had its origin through dispersal from Java; there is now a fairly wide gap in distribution, and recent collections made in southern Celebes have not filled it.

The trilete spores of *Trigonospora* (which I believe are unique in Thelypteridaceae) are very similar to spores of *Cyathea*, and this is one of numerous facts which suggest a relationship of this family to *Cyathea*. Though *Trigonospora* as exists today can hardly represent the primitive state of Thelypteridaceae, I believe that it is a relic of one of the earlier

groups into which the family became diversified. Perhaps another such group is *Coryphopteris* (in Blumea 19:33, 1971) the species of which are confined to peaty soil of high ridges of mountain forest throughout Malesia; these plants have in common with *Trigonospora* in erect caudex, which I believe also is a primitive character.

#### KEY TO THE MALESIAN SPECIES

1. Edges of pinnae lobed to less than 1 mm from costa, lobes narrow with wide sinuses between them; indusia glabrous.
2. Pinnae 3—4 cm long, 10—12 mm wide above auricled base; lobes (except basal acroscopic one) not narrowed towards their bases . . . . 1. *T. calcarata*
2. Pinnae to 8 × 2 cm, basal acroscopic lobe not much elongate; pinna-lobes widest  $\frac{1}{3}$  from their apices . . . . . 2. *T. koordersii*
1. Edges of pinnae lobed to  $1\frac{1}{2}$ —2 mm from costa; lobes wider than sinuses between them; indusia hairy . . . . . 3. *T. ciliata*

#### 1. *Trigonospora calcarata* (Bl.) Holt., *comb. nov.*

*Aspidium calcaratum* Bl., Enum. Pl. Jav. 159. 1828; Racib., Fl. Buitenz. 1: 170. 1898. — *Lastrea calcarata* (Bl.) Moore, Ind. Fil. 87, 1858, non Bedd., Handb. Ferns Brit. India 25. 1883. — *Nephrodium calcaratum* (Bl.) Hook., Spec. Fil. 4: 93 1862 p.p. — *Dryopteris calcarata* (Bl.) O. Ktze, Rev. Gen. Pl. 2: 812. 1891; v.A.v.R., Handb. Mal. Ferns 185. 1908 p.p.; Backer & Posth. Varenfl. Java 38. 1939. — *Thelypteris calcarata* (Bl.) Ching in Bull. Fan Mem. Inst. Biol. Bot. 6: 288. 1936. — TYPE: Blume, Java (L).

*Aspidium reinwardtianum* Kunze ex Mett., Farngatt. 4: 86. 1858. — LECTOTYPE: Zollinger 1600 (B; dupl. G, Fi).

*Dryopteris marthae* v.A.v.R. in Bull. Jard. Bot. Btzg II, 1: 7. 1911. — TYPE: Backer 262, G. Slamet 900 m (BO).

Stipe 8—20 cm long, dark at base, glabrescent except in groove; frond 10—20 cm long, pinnae to 12 pairs; largest pinnae 3—4 cm long, 10—12 mm wide above base, lobed to less than 1 mm from costa; lobes ca 8 pairs, narrow, very oblique except basal acroscopic one which is elongate, close to rachis and almost free; veins ca. 6 pairs; rachis, costae and costules sparsely hairy on lower surface; sori near costules; indusia dark, firm, glabrous; sporangia lacking gland-bearing hairs on their stalks.

DISTRIBUTION: Ceylon?; throughout Java at 100—1000 m alt.; in southern Sumatra and northwards to Padang Highlands.

Kunze did not explain why he thought *Zollinger 1600* did not represent Blume's species (see Bot. Zeit. 6:261, 1848, where he published the name but no description).

#### 2. *Trigonospora koordersii* (Christ) Holtt., *comb. nov.*

*Aspidium koordersii* Christ in Ann. Jard. Bot. Buitenz. 15:128, t. 15, fig. 17, 1897. — *Dryopteris koordersii* (Christ) C. Chr., Ind. Fil. 273, 1905; v.A.v.R., Handb. 181, 1908. — TYPE: *Koorders 1700*, Celebes, Biwak Pondok Punpang, near Kawawutu, 50 m (P, BO, L).



Stipe 15 cm, glabrous. Frond to 24 cm long, pinnae 8 pairs; largest pinnae 8 cm long, 2 cm wide, distinctly stalked, lobed almost to midrib; lobes at ca 45° to costa, to 15 mm long, 1½—2 mm wide, widest ⅓ from apex and narrowed towards base, basal acroscopic lobe not much longer than next; sparse rather thick hairs on lower surface of costules only; veins 8—12 pairs; sori medial; indusium firm, dark glabrous; sporangia short-stalked, lacking a glandular hair on the stalk.

DISTRIBUTION: only known from the original collection.

In *Blumea* 19:30. 1971, I wrongly placed *Aspidium koordersii* in the list of species under *Mesophlebion* subgen. *Plesioneuron*, overlooking its close resemblance to *T. calcarata* in shape of fronds and of pinnae.

### 3. TRIGONOSPORA CILIATA (Benth.) Holtt.

*Lastrea ciliata* Hook., Journ. Bot. Kew Misc. 9: 338. 1857, non Liebm. — *Aspidium ciliatum* Benth., Fl. Hongkong. 455. 1861. — *Nephrodium calcaratum* Hook., Spec. Fil. 4: 93. 1862, p.p. — *Lastrea calcarata* var. *ciliata* Bedd., Handb. Ferns. Brit. India 235. 1883, p.p. — *Dryopteris ciliata* (Benth.) C. Chr. ex Wu et al. in Bull. Dept. Biol. Sunyatsen Univ. no. 3: 30, pl. 6. 1932. — *Thelypteris ciliata* (Benth.) in Bull. Fan Mem. Inst. Biol. Bot 6: 289. 1936. — *Pseudocyclosorus ciliatus* (Benth.) Ching in Acta Phytotax. Sinica 8: 324. 1963 — *Trigonospora ciliata* (Benth.) Holtt., *Blumea* 19: 29. 1971. — LECTOTYPE: „Bowman” (*Bowring*), Hong Kong (K).

*Dryopteris pinnata* Copel. in Univ. Cal. Publ. Bot. 14: 373. 1929. — *Thelypteris pinnata* (Copel.) Ching in Bull. Fan Mem. Inst. Biol. Bot. 10: 253. 1941. — *Lastrea pinnata* (Copel.) Copel., Gen. Fil. 139. 1947. — TYPE: *Bartlett 6641*, Sumatra, Asahan river (UC, L).

Stipe of sterile fronds 10—15 cm long, of fertile to 25 cm; frond to 20 cm long, pinnae ca. 14 pairs, largest 4—5 cm long, 10—12 mm wide above the base, lobed to 1½—2 mm from costa; lobes oblique, rather triangular, basal acroscopic lobe a little elongate; veins 5—6 pairs; lower surface of rachis and costa bearing copious soft pale spreading hairs 1 mm long, shorter ones on costules and veins; sori near costules; indusia large, very hairy; stalk of sporangium bearing a hair of 3 cells, end cell swollen.

DISTRIBUTION: N. India and S. China southwards to northern part of Malaya and northern Sumatra.